Norman H. Bangerter
Governor
Dee C. Hansen
Executive Director
Dianne R. Nielson, Ph.D.
Division Director

State of Utah

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203
801-538-5340

March 26, 1990

Mr. Bryan Johnson
Environmental Specialist
Hecla Mining Company
6500 Mineral Drive
Box C-8000
Coeur d'Alene, Idaho 83814-1931

Dear Mr. Johnson:

Re: Tailing Pond Decommissioning and Reclamation, M/021/004, Iron County, Utah

Pursuant to our meeting on Feb. 27, 1990, the Division is in the process of developing more specific reclamation requirements for the tailing pond facility. This letter addresses the Division's present thinking regarding this reclamation.

After review of the tailing pond analyses which you presented to us at the meeting, we have decided that the deleterious nature of the material will require a more comprehensive approach then that initially submitted by Hecla in the September 8, 1989 tailings pond closure proposal. We now feel that it will be necessary to isolate this material as much as possible from the environment. Our intention is to work with Hecla in determining the most economically feasible solution to this problem.

The high levels of heavy metals indicated by the results, suggest the possibility for groundwater or surface water problems, if leachates produced in the pond escape beyond the pond's boundaries. This would be especially true if the pH levels in the pond were to drop below their present levels of 9.5 to 9.8. Concentrations of heavy metals residing in the pond are loosely complexed and would become easily mobilized in a more acid environment. After the leaching solutions have been turned off, the leached material may return to a more neutral pH. This will be especially true if the material is flushed with a fresh water solution before abandonment.

Other problems indicated by the samples originating from the tailing material, are the levels of sodium (Na) and the associated SAR values. SAR values greater than 15 indicate sodic soils. Results from the analyses show SAR values ranging from 35.4 to 113.2. Excess sodium, in the soil profile, affects plant growth by causing a deterioration or dispersion of the soil structure. This deterioration causes restricted water availability to plants. It also restricts aeration, root elongation and seedling development. Sodic soils also affect plant growth by inhibiting nutritional access of calcium and magnesium. High salt content often associated with sodic soils can also have a detrimental effect on plants. However, the EC values indicated in your analyses show a low to medium range for EC (1.2 to 3.7). Values over 4 mmhos/cm are considered an indication of a saline soil.

Because of the necessity to isolate this material we are asking that Hecla change the original, September 8, 1989, proposal of capping the pond with 6 inches of waste rock and 4 inches of topsoil. This proposal would not allow for a sufficient depth of cover to prevent excess moisture from entering the pond, thus allowing for the build up of potentially dangerous leachates over time. The proposed soil depth is also not a sufficient plant growth medium. The proposed depth of cover above the deleterious sodic tailing (10 to 12 inches), would not be adequate to allow healthy plant growth, because plant root growth would be prevented from extending into the tailing.

It is likely that the Division will ask Hecla to implement one of two scenarios:

1. either cap the tailing with a one foot clay cap (as was proposed by Hecla at our February 27, 1990 meeting) and include an additional 3 to 4 feet of topsoil material;

2. construct a 1 to 1.5 foot capillary barrier with the same amount of topsoil over it. The additional depth of topsoil material would be needed to provide an adequate and safe rooting medium for plants.

The capillary barrier would be used to prevent capillary rise or wicking of contaminants above the tailings surface. However, it would not prevent water entering the soil profile from eventually infiltrating into the tailing.

A clay cap compacted to a minimum conductivity of 1×10^{-6} cm/sec, would act to prevent water infiltration into the tailings and vice versa. Two problems may arise in the use of a clay cap: 1. given the nature of the tailing material the clay may be difficult to compact, and 2. a clay cap will act to prevent any natural neutralization of the tailing material over time, effectively encapsulating the tailing. The clay cap option, however, would probably be the most desirable option of the two.

Because of the added expense of borrowing and compaction of the clay material, the Division will consider allowing Hecla to use the capillary barrier option, with the following condition. Hecla must provide evidence that the capillary barrier along with a sufficient depth of topsoil, will be sufficient to keep unacceptable amounts of moisture from reaching the tailing. Because the pond is located in a low precipitation area, it is possible to eliminate water infiltration into the tailing material with an adequate soil cover. Runoff, evapotranspiration, and capillary rise should remove water from the tailing surface in a greater quantity than what is deposited there. A build up of leachate after abandonment of the site is not desirable, and any cover design for the pond must take this into consideration.

It is possible that the tailing themselves could be used as the restrictive barrier. Your March 1, 1990 letter indicates that they have an average permeability of 1.9×10^{-5} cm/sec. Tailing material of a highly dispersed nature, due to sodium, have been used in the past for liners and caps for impoundments. Another advantage to their use is the fact that they don't require compaction.

The Division contacted Mr. Paul Carter of the Bureau of Land Management's Cedar City District, concerning the reclamation of the pond and the new developments regarding the results of the analyses. We were told that developing a barrow area to aid in reclaiming the site would not be out of the question. We have sent the BLM a copy of this letter and the results of the tailing analyses. We have likewise sent copies to the Division of Environmental Health. After review by these agencies we will be able to get back to you with a much more definitive direction concerning the development of the final reclamation plan for the tailing pond. We hope to get back to you with this information by April 15, 1990.

Thank you for your attention and patience as we work out the details.

Sincerely,

D. Wayne Hedberg

Holland Shepherd
Reclamation Soils Specialist

Attachments
cc: Paul Carter, Cedar City District, BLM
Phil Burns, Bureau of Solid and Hazardous Wastes
Lowell Braxton
Minerals Team
WMN/1-3

A&L MID WEST LABORATORIES, INC.

13611 "B" STREET • OMAHA, NE 68144 • (402) 334-7770

REPORT NUMBER 9-180-1551/1555

June 29, 1989 M5

Hecla Mining Company #9595
P. O. Box 310
Enterprise, UT 84725

Subject: Coal & Overburden Analysis

Number of Samples: 5

Laboratory Number	11345	11346	11347	11348	11349
Sample Identification	#1	#2	#3	Top Soil	Waste Pile
pH	9.8	9.5	9.7	8.2	8.3
Total Sulfur (S) %	0.29	0.21	0.33	0.04	0.14
Potential Acidity (Maximum) *	9.1	6.6	10.3	1.3	4.4
Pyritic Sulfur (S) %	0.04	0.02	0.01	0.02	< 0.01
Potential Acidity (Actual) *	1.2	< 1.0	< 1.0	< 1.0	< 1.0
Neutralization Potential *	163	151	157	58	116
Acid-Base Potential					
$CaCO_3$ Excess * (+)	162	151	157	88	116
$CaCO_3$ Deficiency *(-)					
Potentially Acid/Toxic**	No	No	No	No	No
Other:					
Water Soluble Calcium (Ca) ppm	9	17	14	64	150
Water Soluble Magnesium (Mg) ppm	1	2	1	10	19
Water Soluble Sodium (Na) ppm	420	1830	1630	51	53
Sodium Absorption Ratio (SAR)	35.4	111.8	113.2	1.6	1.1
Sulfate Sulfur SO_4-S (%)	0.07	0.06	0.10	0.01	0.08

* Tons $CaCO_3$ equivalent per 1,000 tons of material.

** pH less than 4.0 or acid-base potential deficiency greater than 5.0 tons $CaCO_3$ equivalent per 1,000 tons of material. Indicate yes or no

< Less than

John Torpy, Laboratory Supervisor

Dedicated Exclusively to Providing Quality Analytical Services

A&L MID WEST LABORATORIES, INC.
13611 "B" STREET • OMAHA, NE 68144 • (402) 334-7770

REPORT NUMBER: 9- 180-1551

June 29, 1989 (m5)

SUBJECT: ENVIRONMENTAL ANALYSIS

Hecla Mining Company #9595
Box 310
Enterprise, UT 84725

PO#: EM44288
Date Received: 6-15-89

Laboratory Number	Sample Identification	Analysis	Level Found	Detection Limit	Method
11345	#1	Total Cyanide	36.20 mg/kg	0.2 mg/kg	EPA 9010
		Total Aluminum	12,787 mg/kg	1.00 mg/kg	EPA 6010
		Total Arsenic	139 mg/kg	5.00 mg/kg	EPA 6010
		Total Barium	10,087 mg/kg	0.5 mg/kg	EPA 6010
		Total Cadmium	264 mg/kg	0.5 mg/kg	EPA 6010
		Total Chromium	229 mg/kg	1.00 mg/kg	EPA 6010
		Total Copper	413 mg/kg	1.00 mg/kg	EPA 6010
		Total Iron	15,057 mg/kg	1.00 mg/kg	EPA 6010
		Total Lead	3499 mg/kg	5.00 mg/kg	EPA 6010
		Total Manganese	1783 mg/kg	1.00 mg/kg	EPA 6010
		Total Mercury	0.40 mg/kg	0.02 mg/kg	EPA 7471
		Total Molybdenum	< 1.00 mg/kg	1.00 mg/kg	EPA 6010
		Total Nickel	10.9 mg/kg	1.00 mg/kg	EPA 6010
		Total Silver	23.3 mg/kg	1.00 mg/kg	EPA 6010
		Total Titanium	975 mg/kg	100 mg/kg	Flame AA
		Total Zinc	5503 mg/kg	1.00 mg/kg	EPA 6010
		Total Solids	87.2%	0.01%	SM 209F
		Extractable Selenium by AB-DTPA	< 0.05 mg/kg	0.05 mg/kg	SM 303E

Note: <= Less than

Respectfully submitted,

John Torpy
Laboratory Supervisor

Dedicated Exclusively to Providing Quality Analytical Services

A&L MID WEST LABORATORIES, INC.

13611 "B" STREET • OMAHA, NE 68144 • (402) 334-7770

REPORT NUMBER: 9- 180-1552

June 29, 1989 (m5)

SUBJECT: ENVIRONMENTAL ANALYSIS

Hecla Mining Company #9595
Box 310
Enterprise, UT 84725

PO#: EM44288
Date Received: 6-15-89

Laboratory Number	Sample Identification	Analysis	Level Found	Detection Limit	Method
11346	#2	Total Cyanide	116.9 mg/kg	0.2 mg/kg	EPA 9010
		Total Aluminum	15,148 mg/kg	1.00 mg/kg	EPA 6010
		Total Arsenic	288 mg/kg	5.00 mg/kg	EPA 6010
		Total Barium	6,907 mg/kg	0.5 mg/kg	EPA 6010
		Total Cadmium	40.7 mg/kg	0.5 mg/kg	EPA 6010
		Total Chromium	17.2 mg/kg	1.00 mg/kg	EPA 6010
		Total Copper	623 mg/kg	1.00 mg/kg	EPA 6010
		Total Iron	12,273 mg/kg	1.00 mg/kg	EPA 6010
		Total Lead	6,425 mg/kg	5.00 mg/kg	EPA 6010
		Total Manganese	1,466 mg/kg	1.00 mg/kg	EPA 6010
		Total Mercury	0.39 mg/kg	0.02 mg/kg	EPA 7471
		Total Molybdenum	< 1.00 mg/kg	1.00 mg/kg	EPA 6010
		Total Nickel	560 mg/kg	1.00 mg/kg	EPA 6010
		Total Silver	61.9 mg/kg	1.00 mg/kg	EPA 6010
		Total Titanium	759 mg/kg	100 mg/kg	Flame AA
		Total Zinc	8,132 mg/kg	1.00 mg/kg	EPA 6010
		Total Solids	88.3%	0.01%	SM 209F
		*Extractable Selenium by AB-DTPA	< 0.05 mg/kg	0.05 mg/kg	SM 303E

Note: <= Less than

Respectfully submitted,

John Torpy
Laboratory Supervisor

Dedicated Exclusively to Providing Quality Analytical Services

A&L MID WEST LABORATORIES, INC.
13611 "B" STREET • OMAHA, NE 68144 • (402) 334-7770

REPORT NUMBER: 9- 180-1553
(Corrected Report 7-26-89)

June 29, 1989 (m5)

SUBJECT: ENVIRONMENTAL ANALYSIS

Hecla Mining Company #9595
Box 310
Enterprise, UT 84725

PO#: EM44288
Date Received: 6-15-89

Laboratory Number	Sample Identification	Analysis	Level Found	Detection Limit	Method
11347	#3	Total Cyanide	83.9 mg/kg	0.2 mg/kg	EPA 9010
		Total Aluminum	11,849 mg/kg	1.00 mg/kg	EPA 6010
		Total Arsenic	169 mg/kg	5.00 mg/kg	EPA 6010
		Total Barium	6,709 mg/kg	0.5 mg/kg	EPA 6010
		Total Cadmium	32.4 mg/kg	0.5 mg/kg	EPA 6010
		Total Chromium	15.4 mg/kg	1.00 mg/kg	EPA 6010
		Total Copper	593 mg/kg	1.00 mg/kg	EPA 6010
		Total Iron	9,942 mg/kg	1.00 mg/kg	EPA 6010
		Total Lead	5,150 mg/kg	5.00 mg/kg	EPA 6010
		Total Manganese	2,185 mg/kg	1.00 mg/kg	EPA 6010
		Total Mercury	0.40 mg/kg	0.02 mg/kg	EPA 7471
		Total Molybdenum	< 1.00 mg/kg	1.00 mg/kg	EPA 6010
		Total Nickel	4.74 mg/kg	1.00 mg/kg	EPA 6010
		Total Silver	10.7 mg/kg	1.00 mg/kg	EPA 6010
		Total Titanium	556 mg/kg	100 mg/kg	Flame AA
		Total Zinc	6,934 mg/kg	1.00 mg/kg	EPA 6010
		Total Solids	86.3%	0.01%	SM 209F
		Extractable Selenium by AB-DTPA	< 0.05 mg/kg	0.05 mg/kg	SM 303E

Note: <= Less than

Respectfully submitted,

John Torpy
Laboratory Supervisor

Dedicated Exclusively to Providing Quality Analytical Services

A&L MID WEST LABORATORIES, INC.
13611 "B" STREET • OMAHA, NE 68144 • (402) 334-7770

REPORT NUMBER: 9- 180-1554
(Corrected Report 7-27-89)

June 29, 1989 (m5)

SUBJECT: ENVIRONMENTAL ANALYSIS

Hecla Mining Company #9595
Box 310
Enterprise, UT 84725

PO#: EM44288
Date Received: 6-15-89

Laboratory Number	Sample Identification	Analysis	Level Found	Detection Limit	Method
11348	Top Soil	Total Cyanide	< 0.2 mg/kg	0.2 mg/kg	EPA 9010
		Total Aluminum	18,724 mg/kg	1.00 mg/kg	EPA 6010
		Total Arsenic	< 5.00 mg/kg	5.00 mg/kg	EPA 6010
		Total Barium	244 mg/kg	0.5 mg/kg	EPA 6010
		Total Cadmium	< 0.5 mg/kg	0.5 mg/kg	EPA 6010
		Total Chromium	15.2 mg/kg	1.00 mg/kg	EPA 6010
		Total Copper	< 1.00 mg/kg	1.00 mg/kg	EPA 6010
		Total Iron	16,418 mg/kg	1.00 mg/kg	EPA 6010
		Total Lead	< 5.00 mg/kg	5.00 mg/kg	EPA 6010
		Total Manganese	634 mg/kg	1.00 mg/kg	EPA 6010
		Total Mercury	0.06 mg/kg	0.02 mg/kg	EPA 7471
		Total Molybdenum	< 1.00 mg/kg	1.00 mg/kg	EPA 6010
		Total Nickel	12.0 mg/kg	1.00 mg/kg	EPA 6010
		Total Silver	< 1.00 mg/kg	1.00 mg/kg	EPA 6010
		Total Titanium	1,650 mg/kg	100 mg/kg	Flame AA
		Total Zinc	76.1 mg/kg	1.00 mg/kg	EPA 6010
		Total Solids	97.7%	0.01%	SM 209F
		Extractable Selenium by AB-DTPA	0.09 mg/kg	0.05 mg/kg	SM 303E

Note: < = Less than

Respectfully submitted,

John Torpy
Laboratory Supervisor

Dedicated Exclusively to Providing Quality Analytical Services

A&L MID WEST LABORATORIES, INC.
13611 "B" STREET • OMAHA, NE 68144 • (402) 334-7770

REPORT NUMBER: 9- 180-1555

June 29, 1989 (m5)

SUBJECT: ENVIRONMENTAL ANALYSIS

Hecla Mining Company #9595
Box 310
Enterprise, UT 84725

PO#: EM44288
Date Received: 6-15-89

Laboratory Number	Sample Identification	Analysis	Level Found	Detection Limit	Method
11349	Waste Pile	Total Cyanide	< 0.2 mg/kg	0.2 mg/kg	EPA 9010
		Total Aluminum	12,970 mg/kg	1.00 mg/kg	EPA 6010
		Total Arsenic	179 mg/kg	5.00 mg/kg	EPA 6010
		Total Barium	1,404 mg/kg	0.5 mg/kg	EPA 6010
		Total Cadmium	20.8 mg/kg	0.5 mg/kg	EPA 6010
		Total Chromium	3.36 mg/kg	1.00 mg/kg	EPA 6010
		Total Copper	233 mg/kg	1.00 mg/kg	EPA 6010
		Total Iron	986 mg/kg	1.00 mg/kg	EPA 6010
		Total Lead	2,754 mg/kg	5.00 mg/kg	EPA 6010
		Total Manganese	1,162 mg/kg	1.00 mg/kg	EPA 6010
		Total Mercury	0.18 mg/kg	0.02 mg/kg	EPA 7471
		Total Molybdenum	< 1.00 mg/kg	1.00 mg/kg	EPA 6010
		Total Nickel	5.16 mg/kg	1.00 mg/kg	EPA 6010
		Total Silver	19.6 mg/kg	1.00 mg/kg	EPA 6010
		Total Titanium	468 mg/kg	100 mg/kg	Flame AA
		Total Zinc	2,905 mg/kg	1.00 mg/kg	EPA 6010
		Total Solids	99.8%	0.01%	SM 209F
		Extractable Selenium by AB-DTPA	0.08 mg/kg	0.05 mg/kg	SM 303E

Note: <= Less than

Respectfully submitted,

John Torpy
Laboratory Supervisor

Dedicated Exclusively to Providing Quality Analytical Services

REPORT NUMBER
-174-0116

REPORT DATE
C/29/89

ACCOUNT NO.
9595

GROWER
HECIA MINING COMPANY

A & L MID WEST LABORATORIES, INC.

13611 "B" Street • Omaha, Nebraska 68144-3693 • Phone: (402) 334-7770

TO:
HECIA MINING COMPANY
TANNY HARLIN
BOX 310
ENTERPRISE UT 84725

SUBMITTED BY:

SOIL ANALYSIS REPORT

(SEE EXPLANATION ON BACK) INFO SHEET # 127797

SAMPLE NUMBER	LAB NUMBER	ORGANIC MATTER PERCENT	ORGANIC MATTER RATE	ENR lbs./A	PHOSPHORUS P1 (WEAK BRAY) ppm	PHOSPHORUS RATE	P2 (STRONG BRAY) ppm	P2 RATE	BICARBONATE P ppm	BICARBONATE P RATE	POTASSIUM K ppm	POTASSIUM RATE	MAGNESIUM Mg ppm	MAGNESIUM RATE	CALCIUM Ca ppm	CALCIUM RATE	SODIUM Na ppm	SODIUM RATE	pH SOIL pH	BUFFER INDEX	HYDROGEN H meq/100g	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
	34294	0.3	VL	39	1	VL	2	VL			155	VH	20	VL	1425	H	316	VH	9.8		0.0	9.1	4.4	1.8	78.6	0.0	15.2
	34295	0.3	VL	39	2	VL	3	VL			238	VH	17	VL	1400	M	994	VH	9.5		0.0	12.1	5.1	1.2	58.0	0.0	35.8
	34296	0.3	VL	39	1	VL	2	VL			246	VH	20	VL	1412	M	859	VH	9.7		0.0	11.6	5.4	1.4	60.9	0.0	32.2
	34297	2.1	M	71	21	H	79	VH			481	VH	368	VH	2801	H	36		8.2		0.0	18.5	6.7	16.6	75.9	0.0	0.8

DTPA EXTRACTION

SAMPLE NUMBER	NITRATE NO_3-N ppm	NITRATE RATE	SULFUR S ppm	SULFUR RATE	ZINC Zn ppm	ZINC RATE	MANGANESE Mn ppm	MANGANESE RATE	IRON Fe ppm	IRON RATE	COPPER Cu ppm	COPPER RATE	BORON B ppm	BORON RATE	EXCESS LIME RATE	SOLUBLE SALTS mmhos/cm	SOLUBLE SALTS RATE	% SAND	% SILT	% CLAY	
	2	VL											8.1	VH	H	1.6	L	14	78	8	SILT LOAM
	2	VL											8.0	VH	H	3.7	M	10	84	6	SILT
	2	VL											9	VH	H	3.7	M	10	82	8	SILT
	2	VL											1.8	H	H	1.2	L	38	46	16	LOAM

CODE TO RATING: VERY LOW (VL), LOW (L), MEDIUM (M), HIGH (H), VERY HIGH (VH), AND NONE (N)
NR - ESTIMATED NITROGEN RELEASE
MULTIPLY THE RESULTS IN ppm BY 2 TO CONVERT TO LBS. PER ACRE OF THE ELEMENTAL FORM

···· MULTIPLY THE RESULTS IN ppm BY 4.6 TO CONVERT TO LBS. PER ACRE P_2O_5
···· MULTIPLY THE RESULTS IN ppm BY 2.4 TO CONVERT TO LBS. PER ACRE K_2O
MOST SOILS WEIGH TWO (2) MILLION POUNDS (DRY WEIGHT) FOR AN ACRE OF SOIL 6-2/3 INCHES DEEP.

(801)439-5355 Zone 5

COMMENTS:

The sample identified as waste pile consisted entirely of particle sizes of cobbles and course gravel. This material was pulvarized and analyzed for the parameters requiring total element content. It was not analyzed for extractable or exchangeable nutrients.

A & L MID WEST LABORATORIES, INC.

Ken Pohlman/John Mengnini
AL Rev 6.1 MG